

# **EXHIBIT 38**

UNITED STATES DISTRICT COURT  
NORTHERN DISTRICT OF CALIFORNIA  
SAN JOSE DIVISION

CISCO SYSTEMS, INC., )  
)  
Plaintiff, )  
) Case No.  
vs. ) 5:14-cv-05344-BLF (PSG)  
)  
ARISTA NETWORKS, INC., )  
)  
Defendant. )  
\_\_\_\_\_)

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VIDEOTAPED DEPOSITION OF KIRK LOUGHEED  
Palo Alto, California  
Friday, November 20, 2015  
Volume I

Reported by:  
CARLA SOARES  
CSR No. 5908  
Job No. 2187110  
Pages 1 - 189

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1           A    Could you explain to me what you mean by           11:09:26  
2    "parser"?  
3           Q    Do you know what a parser is?  
4           A    I know in a generic sense what a parser  
5    is.   11:09:45  
6           Q    What's a parser in your -- based on your  
7    understanding?  
8           A    A parser is something that takes a string  
9    of text and divides it up into a sequence of tokens,  
10   and then takes some action based on those sequence           11:10:09  
11   of tokens.  
12          Q    Based upon that understanding, do you know  
13   whether EXEC had a parser?  
14          A    Yes.  
15          Q    It did?   11:10:25  
16          A    It did.  
17          Q    How do you know that it had a parser?  
18          A    Because it had the behavior that I  
19   described.  
20          Q    Had you ever seen the EXEC source code?           11:11:03  
21          A    Yes.  
22          Q    And had you seen the parser code of EXEC?  
23          A    I had seen parts of it.  
24          Q    How did you come to see that code?  
25          A    It was -- Stanford had a source license to       11:11:33

1 that software. 11:11:38

2 Q So you saw the EXEC source sometime during  
3 your time at Stanford?

4 A Yes.

5 Q Why did you look at the EXEC source code? 11:12:02

6 A To apply patches, fix bugs.

7 Q How often would you have to fix bugs in  
8 the TOPS-20 code, do you recall?

9 A I do not recall -- recall the frequency.

10 Q Do you understand whether there was a 11:13:26  
11 privileged mode in TOPS-20?

12 A Yes. There is -- there is a privileged  
13 mode.

14 Q And what distinguishes a privileged mode  
15 from any other mode? 11:13:50

16 A The -- assuming that you had access to the  
17 privileged mode or the privileged -- to additional  
18 privileges, it would change the -- change the prompt  
19 character.

20 Q Do you know what the prompt character was 11:14:29  
21 in the privileged mode?

22 A Yes.

23 Q What was it?

24 A Stanford used an exclamation mark. DEC

25 had a character -- a different character that I 11:14:49

1 don't remember. 11:14:51

2 Q Did privileged mode allow you a different

3 set of commands than in a non-privileged mode?

4 A There were a -- yes.

5 Q What are some of the examples of different 11:15:27

6 commands you could get in privileged mode as opposed

7 to non-privileged mode?

8 A One of the things was you could control a

9 printer, a printer software.

10 Q How would one get into privileged mode in 11:15:53

11 TOPS-20?

12 A Assuming your user ID had the privileges,

13 you could give a command called "enable."

14 Q Is that all, just "enable"? Yes?

15 A Yes. 11:16:34

16 Q Okay. So "enable" combined with your user

17 ID could get you into privileged mode?

18 A Correct.

19 Q Are you familiar with the syntax of

20 TOPS-20 commands? 11:17:00

21 A In a -- yes.

22 Q Can you explain what it is?

23 A There are many commands. I do not

24 remember all of them.

25 Q Was there a general format for TOPS-20 11:17:37

1 commands, to your recollection? 11:17:42

2 A Yes.

3 Q What was that format?

4 A Again, there are many commands, and I  
5 don't remember all the details of those commands. 11:18:10

6 Q Okay. Do you -- I was trying to get  
7 beyond that by asking you a general question about  
8 the format that might be applicable to a range of  
9 commands.

10 Is there such a thing, to your knowledge? 11:18:27

11 MR. NEUKOM: Objection to form. Vague.

12 THE WITNESS: The -- the EXEC -- the  
13 number of such commands was large and varied. And  
14 DEC appeared to have a standard way of doing things,  
15 but I don't remember all the details. 11:18:55

16 BY MR. FERRALL:

17 Q Okay. Can you tell me anything you  
18 remember about the way TOPS-20 commands were  
19 formatted as a general matter?

20 MR. NEUKOM: Objection to form. 11:19:20

21 THE WITNESS: There would be a leading  
22 keyword, perhaps one or two leading keywords. There  
23 was -- to help people along, you could hit an  
24 "escape" key. You would complete -- it might print  
25 out something called a guide word. 11:20:05

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1 different modes are there? 14:23:20

2 A A lot.

3 Q Do you know how many?

4 A No, not at present.

5 Q More than five? 14:23:44

6 A Yes.

7 Q More than ten?

8 A Probably.

9 Q Were there different modes in the

10 original -- actually, strike that. 14:24:04

11 Let me ask terminology.

12 What did you call the original Cisco

13 software before it became known as IOS?

14 A The gateway software. The router

15 software. The terminal server software. The AGS 14:24:25

16 software. There was no branding.

17 Q This Exhibit 37 refers to "AGS User

18 Manual."

19 What does AGS stand for?

20 A Advanced gateway server. 14:24:45

21 Q Okay. At the time of Version 6 of the

22 Cisco software, how many different modes were there,

23 do you know?

24 A So I don't understand how you're using the

25 word "mode." 14:25:21

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1 Q Did Cisco use the word "mode" in 14:25:27  
2 describing its functionality of its software?

3 A We had -- there would be -- the phrase  
4 "configuration mode" was certainly being used at  
5 this time. 14:25:46

6 Q Okay. And how did -- how did  
7 "configuration mode" differ from any other mode of  
8 operation?

9 A It allowed you to type in command  
10 expressions that affected the configuration of the 14:26:04  
11 system.

12 Q And if you weren't in configuration mode,  
13 how would you describe whatever mode you were in?

14 A You were -- at this time you would have  
15 said you are at the EXEC. 14:26:32

16 Q What does "EXEC" mean?

17 A It was the term that I chose to refer to  
18 the -- all the stuff that wasn't the configuration  
19 mode.

20 Q Give me an example of what that stuff is 14:27:08  
21 or was.

22 A The commands for connecting to other  
23 computers on the network, the class of command  
24 expressions that we call the "show" commands.

25 Basically the set of commands that did not 14:27:48



1 reveal -- basically mostly status commands and ones 14:27:53  
2 for handling connections over the network to other  
3 hosts, sort of a subset of the -- of the terminal  
4 server commands.

5 Q And you said you chose the term "EXEC," 14:28:26  
6 that's E-X-E-C; is that right?

7 A Yes.

8 Q You chose that term, yes?

9 A Yes.

10 Q How did you come up with that term? 14:28:39

11 A Well, I had a number of possible ways of  
12 describing it. I could have used "shell" after  
13 the -- modeling it along the UNIX way of -- UNIX  
14 equivalent.

15 From -- I decided EXEC in sort of -- you 14:29:15  
16 know, inspired by the TOPS-20 command processor.  
17 You know, calling it the command processor would  
18 have been another possibility.

19 There was a number of possibilities that I  
20 could have called it, what I could have called that 14:29:38  
21 particular part of the software, and I ended up  
22 choosing EXEC.

23 Q Now, were you responsible for determining  
24 the prompt symbol on the interface?

25 I'm sorry. Let me be clear. 14:30:26

1 I'm talking about on the interface line, 14:30:28  
2 there are symbols that precede the input point, such  
3 as a hash sign, for example, right?

4 A So for -- I was responsible for choosing  
5 the prompts for the command line interface, for the 14:30:45  
6 CLI.

7 Q Okay. And tell me what those prompts are,  
8 the various prompts that the Cisco CLI uses.

9 A There are many right now. But at the time  
10 there was the -- the unprivileged EXEC commands, and 14:31:09  
11 that was the host name of the -- of the router or --  
12 of the router, followed by a close angle bracket.

13 There was a privileged mode, and it  
14 changed that prompt to a hash mark.

15 And in the initial implementation of 14:31:55  
16 configuration mode, there was no prompt.

17 Q Okay. How did you choose the hash prompt  
18 for the privileged mode?

19 A It was visually large and different than  
20 the -- different -- just different than the 14:32:25  
21 unprivileged EXEC prompt.

22 Q Okay. How did you use the unprivileged  
23 close angle bracket prompt?

24 A I don't understand your question.

25 Q Did you choose to use the close angle 14:32:59

1 A He worked for IBM. 15:34:52

2 Q What was Mr. Rekhter's contribution to the

3 BGP RFC? The first one?

4 A We were co-designers.

5 Q Are you able to describe what he 15:35:28

6 contributed as opposed to what you contributed?

7 A No. We worked closely together.

8 Q Do you know whether you ever made any

9 declarations to the IETF concerning copyrights that

10 Cisco claimed in any of the language in the first 15:35:57

11 BGP RFC?

12 MR. NEUKOM: Objection. Vague, compound.

13 THE WITNESS: To the best of my

14 recollection, we made no copyright claims in the

15 first BGP RFC. 15:36:17

16 BY MR. FERRALL:

17 Q Did Cisco make any disclosures to the IETF

18 regarding copyright claims in any of the BGP RFCs?

19 MR. NEUKOM: Objection. Compound, vague.

20 THE WITNESS: Not to my knowledge. 15:36:35

21 BY MR. FERRALL:

22 Q Did you ever make a disclosure to the

23 Internet Architecture Board of any intellectual

24 property rights in BGP, to your knowledge?

25 A To my knowledge -- 15:36:57

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1 MR. NEUKOM: Objection. Compound, vague. 15:37:00

2 THE WITNESS: -- we did not make any such  
3 assertions.

4 MR. NEUKOM: And foundation.

5 BY MR. FERRALL: 15:37:08

6 Q Did you ever have an agreement with  
7 Mr. Rekhter about the right to use any of his  
8 contributions to the BGP work that you guys did?

9 MR. NEUKOM: Vague, compound, calls for a

10 legal conclusion -- 15:37:44

11 THE WITNESS: Could you --

12 MR. NEUKOM: -- and mischaracterizes prior

13 testimony.

14 THE WITNESS: Could you repeat the

15 question, please? 15:37:59

16 BY MR. FERRALL:

17 Q Sure. I'll ask a slightly different

18 question.

19 Did you ever ask permission from

20 Mr. Rekhter to use any of his contributions to the 15:38:09

21 BGP project?

22 MR. NEUKOM: Objection. Vague, compound,

23 calls for a legal conclusion.

24 THE WITNESS: We did not seek permission

25 from one another for our individual contributions. 15:38:26

1 BY MR. FERRALL: 15:38:30

2 Q Okay. IBM didn't ask you for permission,  
3 either, correct?

4 A No.

5 Q One of the CLI terms in this case is the 15:39:20  
6 term "IP address."

7 Are you familiar with that?

8 A I'm familiar with the command expression  
9 "IP address."

10 Q Did you come up with the phrase "IP 15:39:33  
11 address"?

12 A When Cisco came out of Stanford, we were  
13 shipping an IP -- an Internet protocol only router.  
14 And there was a command "address" that took some  
15 arguments. 15:40:12

16 And after -- after a while, we started  
17 adding other protocols to the software. The first  
18 one was "DECnet." And since "address" was already  
19 taken to refer to IP functionality, Internet  
20 protocol functionality, we came up with "DECnet 15:40:44  
21 address," and then had a DECnet address after it.

22 That "DECnet address" command could have  
23 very well have said "address," and then DECnet  
24 addresses look different than IP addresses, and we  
25 could have had the software figure out which type of 15:41:11

1 address we were referring to. But we chose "DECnet 15:41:13  
2 address."

3 It became clear that much more -- that we  
4 were becoming a multi-protocol router. We were  
5 adding other protocols into the box, into the 15:41:27  
6 software.

7 And I had -- I value -- I value the  
8 aesthetic of having a symmetric-looking command line  
9 expression, symmetric hierarchy. It was clear we  
10 were heading towards a hierarchy. 15:41:52

11 So at some point after DECnet and perhaps  
12 a few other protocols to make things look very  
13 similar, we started prefacing our IP-only commands  
14 with "IP." And that gave a very -- what I thought  
15 was a very elegant, symmetric, elegant way of 15:42:16  
16 referring to different protocols within a  
17 multi-protocol router.

18 So that is the history of the "IP address"  
19 command.

20 Q Okay. My question was simpler. I 15:42:36  
21 appreciate that answer. But my question was a  
22 little simpler than that, but let me ask it a  
23 different way.

24 You had heard of the term "IP address"  
25 before you joined Cisco, hadn't you? 15:42:51

1 MR. NEUKOM: Objection. Vague and asked 15:42:59  
2 and answered.

3 THE WITNESS: I suppose I had. When one  
4 is talking about different networking protocols, one  
5 needs to clarify which networking protocol one is 15:43:10  
6 talking about. So it was probably terminology that  
7 was in the air.

8 BY MR. FERRALL:

9 Q Does the same go for "IP host," also? You  
10 had heard that before you joined Cisco? 15:43:29

11 MR. NEUKOM: Objection. Misstates prior  
12 testimony.

13 THE WITNESS: The original form of the  
14 "host" command was just "host command." It was  
15 another one that had to distinguish, in a 15:43:41  
16 multi-protocol world, in a multi-protocol piece of  
17 software, what you were talking about.

18 It would have looked very odd in a  
19 multi-protocol router that there was one protocol  
20 that wasn't prefaced by a -- some descriptive 15:44:03  
21 keyword.

22 BY MR. FERRALL:

23 Q Following up on that, the purpose of your  
24 use of "IP" as the first keyword in that command "IP  
25 host" was to distinguish the protocol that it's 15:44:33

1 referring to? 15:44:36

2 A That was the aesthetic choice I made.

3 MR. NEUKOM: Objection. Mischaracterizes  
4 prior testimony.

5 THE WITNESS: There were many possible 15:44:49

6 ways of doing it. As I indicated, I could perhaps

7 take a look at an address and then infer what it

8 was. But that was not the choice that I made at the

9 time.

10 BY MR. FERRALL: 15:45:07

11 Q What were the alternative commands that

12 you considered for "IP host"?

13 A "Name." "Name" was certainly one of the

14 possible candidates. "Network system" or

15 "system" -- there are many, many words that one 15:45:51

16 could use to refer to all sorts of different things.

17 Q Okay. But now you're talking about

18 alternatives for the word "host," right?

19 A Um-hum.

20 Q Okay. You didn't -- you're not the first 15:46:08

21 one to use the word "host," are you?

22 A No.

23 Q I mean, "host" had been used for -- well

24 before you joined Cisco to refer to a computer host.

25 It's a conventional term, right? 15:46:29



1 MR. NEUKOM: Objection. Vague, compound, 15:46:31  
2 foundation, and calls for opinion testimony.  
3 THE WITNESS: It was one of the  
4 possibilities that I had -- that I had.  
5 BY MR. FERRALL: 15:46:46  
6 Q And "host" was the term that was used in  
7 the commands in the software that came from  
8 Stanford; is that right?  
9 MR. NEUKOM: Objection. Mischaracterizes  
10 prior testimony. 15:47:13  
11 THE WITNESS: I had implemented the "host"  
12 command while I was at Stanford.  
13 BY MR. FERRALL:  
14 Q Okay. And what did you -- so did you  
15 decide to use the word "host" for the command on the 15:47:27  
16 software you worked at while you were employed by  
17 Stanford?  
18 MR. NEUKOM: Objection. Vague.  
19 THE WITNESS: Could you restate that  
20 question? 15:47:50  
21 BY MR. FERRALL:  
22 Q Sure.  
23 For the software that -- strike that.  
24 For the gateway TIP software that you  
25 worked on while you were employed at Stanford, was 15:48:02

1 it you who decided to use the word "host" for that 15:48:06  
2 command?  
3 A It was -- it was my decision.  
4 Q Okay.  
5 A I believe it was. I believe I -- yes, it 15:48:16  
6 was my decision.  
7 Q And do you know how you came to choose  
8 that word?  
9 A It was -- it was terminology that was in  
10 the air at the time. 15:48:42  
11 Q And at some later point -- let me ask you,  
12 so when did you decide to append "IP" to the "host"  
13 command?  
14 MR. NEUKOM: Objection. Mischaracterizes  
15 prior testimony. 15:49:08  
16 THE WITNESS: Sometime after we had left  
17 Stanford and after we had started putting support  
18 for other protocols into the system.  
19 BY MR. FERRALL:  
20 Q Can you provide a more specific date? 15:49:37  
21 A Not --  
22 MR. NEUKOM: Objection. Asked and  
23 answered.  
24 THE WITNESS: Sometime within the 1987 to  
25 1988 time frame. 15:50:03

1 BY MR. FERRALL: 15:50:10

2 Q Okay. And the purpose of using the "IP"  
3 keyword before "host" was to distinguish this  
4 command from a "host" command that might pertain to,  
5 for example, the DECnet protocol instead? 15:50:31

6 MR. NEUKOM: Objection. Asked and  
7 answered and mischaracterizes prior testimony.

8 THE WITNESS: I felt that symmetry and  
9 consistency within the command set was something  
10 that would be -- was desirable, and we adopted the 15:50:59  
11 convention of finding a -- an initial keyword that  
12 would describe the basic protocol that we were  
13 configuring.

14 BY MR. FERRALL:

15 Q So do all of the commands in the Cisco CLI 15:52:22  
16 that begin with "IP" -- sorry. Strike that.

17 Do all of the Cisco CLI commands that  
18 begin with the keyword "IP" indicate that those  
19 commands are for the IP protocol as opposed to some  
20 other protocol? 15:52:46

21 MR. NEUKOM: Objection. Compound.

22 THE WITNESS: That is the generally  
23 understood convention.

24 BY MR. FERRALL:

25 Q Are you aware of pre-1986 RFCs that 15:53:38

1 discuss the term "IP host"? 15:53:44

2 A No, I'm not.

3 Q Had you ever heard of Internet datagrams?

4 A Yes.

5 Q What are Internet datagrams? 15:55:48

6 A IP packets is the more modern terminology.

7 Q Are you familiar with -- we talked this

8 morning about Jeffrey Mogul from Stanford.

9 A I recall that.

10 Q Okay. Are you aware that he submitted an 15:56:27

11 RFC regarding Internet datagrams?

12 A The vast bulk of the IETF RFCs are about

13 Internet datagrams. So he could very well have done

14 so.

15 Q Are you familiar with a person from 15:57:42

16 Stanford by the last name Deering?

17 A Yes, I know of him.

18 Q First name is Steve, right?

19 A Correct.

20 Q Do you know what he -- what area he worked 15:58:03

21 in?

22 A In what time frame are you referring?

23 Q 1986.

24 A No, I don't know what he was doing in

25 1986. 15:58:24

1 Q Were there CLI commands that were 16:06:14  
2 implemented as a result of the software that  
3 Mr. Hedrick provided back to you?

4 A Yes.

5 MR. NEUKOM: Objection. Vague, compound. 16:06:32  
6 BY MR. FERRALL:

7 Q Can you give me some examples?

8 A I don't remember the details of his  
9 command line interface into it.

10 Q Are there records of what Mr. Hedrick 16:06:55  
11 provided to Cisco?

12 A I'm not aware of any records.

13 Q What happened to them, do you know?

14 A Cisco didn't keep records at that stage in  
15 its development. 16:07:07

16 Q Who did Mr. Hedrick interact with at  
17 Cisco?

18 A Myself, Len Bosack. Over time, some of  
19 the other engineers.

20 Q Did you receive the software back from 16:07:45  
21 Mr. Hedrick personally?

22 MR. NEUKOM: Objection. Vague.

23 THE WITNESS: I have no memory of that  
24 transaction.

25 /// 16:08:04

1 BY MR. FERRALL: 16:08:17

2 Q Okay. Do you have any other recollection  
3 as to who actually received the software from  
4 Mr. Hedrick?

5 A No. 16:08:22

6 Q Tell me how -- strike that.

7 Do you believe that you created the  
8 command "IP access list"?

9 MR. NEUKOM: Objection. Vague.

10 THE WITNESS: I -- yes. 16:10:20

11 BY MR. FERRALL:

12 Q What functionality does that implement?

13 A It -- the "access list" command, which I  
14 implemented at Stanford, the original form at  
15 Stanford was a sequence of addresses and subnet  
16 masks or -- in a mask, not a subnet mask but a mask,  
17 saying which bits to ignore in the address.

18 And you provide a list of these items and  
19 give it a number. I chose -- I chose 1, 2, 3, 4, up  
20 to 99, or something like that. 16:11:35

21 And then if you assigned it to a terminal  
22 line, it could restrict what computers -- what  
23 addresses somebody could connect to from that  
24 particular terminal line.

25 You could also assign it to a network 16:11:59

1 interface, and it would -- as a packet that was 16:12:12  
2 being sent -- sent out that interface, it could  
3 either be permitted or denied going through that  
4 interface.

5 Those were the two original uses of the 16:12:29  
6 "access list" command expression.

7 Q Do you believe that you coined the term  
8 "access list"?

9 A It was my choice to use that description.

10 Q Well, I'm asking you if you coined that 16:12:56  
11 term, or had you ever heard that term before in the  
12 context of networking?

13 MR. NEUKOM: Objection. Vague, compound,  
14 asked and answered.

15 THE WITNESS: I do not believe that I had 16:13:13  
16 heard the term before.

17 BY MR. FERRALL:

18 Q Had you heard the term "IP access group"  
19 before?

20 A Yes. 16:13:25

21 Q Who coined that term, to your knowledge,  
22 do you know?

23 A I did.

24 Q Under what circumstances? Or for what  
25 purpose, I should say? 16:13:39

1           A    I don't remember the exact details, but it           16:13:52  
2   is -- either assigns an access list to an interface  
3   or -- I think it assigns an interface to a -- an  
4   access list to an interface.   I believe it's access  
5   class or something like that that assigns it to an           16:14:07  
6   interface or to a line number.

7           Q    The term "domain name" is not a term that  
8   you made up, is it?

9           A    No, I didn't make -- I -- no, I did not.

10          Q    "Domain name" is a term that goes back to           16:15:38  
11   the ARPANET, actually.   Are you aware of that?

12          MR. NEUKOM:   Objection.   Foundation.

13          THE WITNESS:   I would be unsurprised if it  
14   went back that far.

15          Are you referring to ARPANET protocols or           16:16:02  
16   ARPANET network?

17   BY MR. FERRALL:

18          Q    The ARPANET network.

19          A    I believe the concept was introduced while  
20   the ARPANET network was still running.           16:16:15

21          Q    What about the words "domain lookup"?   Did  
22   you coin that term "domain lookup"?

23          MR. NEUKOM:   Objection.   Vague.

24          THE WITNESS:   It's a parallel construction  
25   to terms like "address lookup" or "host lookup" or           16:16:52



1 the like, or "database lookup" or... 16:16:59

2 BY MR. FERRALL:

3 Q Did you coin the term "domain lookup"?

4 A I decided to use that as a command

5 expression within the software, yes. 16:17:21

6 Q I'll ask the question one more time. I'm  
7 asking you if you coined the term "domain lookup."

8 MR. NEUKOM: Objection. Asked and  
9 answered and vague.

10 THE WITNESS: I did not. 16:17:43

11 BY MR. FERRALL:

12 Q Do you know who did?

13 A No idea.

14 Q When was -- to your knowledge, when was  
15 the term "routing" ever used in conjunction with the 16:18:41  
16 Internet protocol?

17 MR. NEUKOM: Objection. Vague and  
18 foundation.

19 THE WITNESS: I don't know when the term  
20 "routing" was used. 16:19:05

21 BY MR. FERRALL:

22 Q Were people in the field talking about  
23 routing in connection with IP before you joined  
24 Cisco?

25 MR. NEUKOM: Objection. Vague, compound. 16:19:24

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1 THE WITNESS: Yes. 16:19:27

2 BY MR. FERRALL:

3 Q Tell me what, if anything, was creative  
4 about your decision to use the term "IP routing" as  
5 a CLI command. 16:19:51

6 MR. NEUKOM: Objection. Calls for opinion  
7 testimony.

8 THE WITNESS: At Stanford where we had  
9 terminal servers and gateways in the same software,  
10 there were times when it was convenient -- just 16:20:26  
11 because something had multiple interfaces, it could  
12 still perhaps be a terminal server. So I needed a  
13 way of turning off, disabling routing functionality.

14 And I used the command -- I chose the  
15 keyword -- configuration keyword command expression 16:21:07  
16 "routing." Then "no routing" would turn off routing  
17 functionality in whatever software was running at  
18 the time despite its hardware configuration.

19 And then later on at Cisco, to keep the --  
20 keep the form of the hierarchy of commands, we added 16:21:35  
21 the -- we added our choice of -- we added "IP" in  
22 front of it because you could potentially turn off  
23 other sorts of routing, or at least that was the --  
24 that was the -- that was a possibility for other  
25 network protocols. 16:22:02

1 BY MR. FERRALL: 16:22:10

2 Q So you mentioned the term "hierarchy" a  
3 couple of times now. So let me ask you to explain  
4 the best you can, what is the hierarchy of the Cisco  
5 CLI command? 16:22:38

6 A I can give you examples. There aren't  
7 many.

8 There's -- on the EXEC commands, you can  
9 have things like "show" as a root of all the  
10 commands that -- the root keyword for all the 16:23:15  
11 commands that show status of the system.

12 And then at the next level in the  
13 hierarchy, you can say, for example, "show  
14 interface," or I could say, "show routing." Or I  
15 could also say -- if I wanted to examine stuff that 16:23:40  
16 was specific to -- specific to some IP-related  
17 component of the system, my next keyword would be  
18 "show IP," and then I would specify something like  
19 "interface." And it would show me -- it would show  
20 me the information about -- all the IP information 16:24:08  
21 about all the interfaces.

22 And then I can extend that command to be  
23 something like an interface name. So "show IP  
24 interface," and then I specify an interface,  
25 "Ethernet zero," and I see all the information 16:24:25

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1 such things. 16:35:35

2 Q Prior to your joining Cisco, were you

3 aware of any operating systems that had two or more

4 commands that began with the same first word?

5 MR. NEUKOM: Objection. Vague. 16:36:02

6 THE WITNESS: Two or more commands that

7 began with the same word. I can't recall any.

8 MR. FERRALL: Let's mark this as the next

9 exhibit.

10 (Exhibit 39 was marked for identification 16:48:10

11 and is attached hereto.)

12 BY MR. FERRALL:

13 Q Exhibit 39 is a document entitled "Cisco's

14 Response to Arista's Interrogatory No. 16 amended

15 Exhibit D-1 (IOS Release 11.0)." 16:37:09

16 And I assume, Mr. Loughheed, that you

17 haven't seen the cover page, but tell me if you've

18 seen any of the inside to Exhibit 39.

19 A I've not seen the inside of this.

20 Q You've never seen these images? 16:37:35

21 A I don't recall having seen them before.

22 Q Okay. So if you look at -- if you go a

23 couple of pages in, let's just take an example of

24 the "clear" command set --

25 A I'd like to page through the rest of this 16:38:14

1 before I offer a -- 16:38:18

2 MR. NEUKOM: Which page are you currently  
3 looking at, Brian?

4 MR. FERRALL: The page that begins with  
5 the "clear" command. It's number 5, I guess. I 16:38:24  
6 didn't realize there were pages on here.

7 MR. NEUKOM: Mr. Simmons has helpfully  
8 reminded me that we've now been on the record for an  
9 hour and 15 minutes. I'm open-minded on timing, but  
10 when we get to a good spot, it would be nice to take 16:38:49  
11 a short break.

12 MR. FERRALL: Okay. Let me just finish  
13 some questions about this.

14 THE WITNESS: Okay. I've scanned it  
15 briefly. 16:39:32

16 BY MR. FERRALL:

17 Q Okay. If you could turn to page 5, which  
18 is where the "clear" command set begins.

19 Are you there?

20 A Yes, I am. 16:39:39

21 Q Okay. At Cisco, do you have a terminology  
22 for the different levels of the hierarchy?

23 A No, no particular terminology for the  
24 hierarchy. There would be a top level command, top  
25 level commands and sub commands. 16:40:14

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1 Q So in this case, there's a command, for 16:40:25  
2 example, "clear ARP-cache," right?

3 A Yes.

4 Q In that command, is that the ARP cache  
5 that's being cleared? 16:40:55

6 A I believe that command clears -- clears  
7 all address resolution caches. There's more than  
8 one address resolution protocol in the system, or at  
9 least there was when we were a primarily  
10 multi-protocol router. 16:41:19

11 Q Okay. If you go to page 6, the next page,  
12 now, for this, "interface Ethernet," is that a  
13 hierarchy?

14 A It is --

15 MR. NEUKOM: Objection. Calls for opinion 16:42:27  
16 testimony.

17 THE WITNESS: It is the leading element of  
18 a hierarchy.

19 One of the choices that I made at Stanford  
20 actually in introducing the "interface" command was 16:42:49  
21 that it assumed a block structure where I could say  
22 things like "interface Ethernet zero," and then I  
23 could say -- I could have a bunch of -- at Stanford  
24 I had a bunch of what we called interface sub  
25 commands that would follow on subsequent lines. 16:43:17

1 I could very well have made the choice to 16:43:21  
2 write that as, on one line, for example, "interface  
3 Ethernet zero address," an IP address, a subnet  
4 mask, and you would have a hierarchy of  
5 configuration stuff. 16:43:44

6 Going outside into Cisco, you could have  
7 "interface Ethernet zero." I could have "IP" and  
8 then a bunch of IP keywords after that. I could  
9 have "interface Ethernet zero DECnet" and have a  
10 bunch of DECnet keywords underneath that. And that 16:44:00  
11 would very clearly demonstrate a hierarchy.

12 I made the aesthetic choice of saying --  
13 of turning the word "interface" -- which I could  
14 have chosen something like "IF" or "net-in" or  
15 something like that, but I chose "interface" -- I 16:44:23  
16 like writing words out -- I chose as a typing  
17 shorthand to say this is the front end of all -- of  
18 the hierarchy for all the rest of these commands.

19 So this does -- it is a hierarchy,  
20 especially in the Cisco multi-protocol world that it 16:44:47  
21 evolved into.

22 BY MR. FERRALL:

23 Q So I'm trying to understand the nature of  
24 your hierarchy.

25 You said, for example, you could have used 16:45:50

1 "IF" instead of "interface." 16:45:51

2 A It was just an example of choice of --

3 choice of word.

4 But under discussion was rather what was a

5 hierarchy here. And these are the -- "interface" 16:46:05

6 with an argument after it is the first part of a

7 hierarchy.

8 You could draw this in a tree shape, and

9 it would be -- the hierarchy would be very obvious.

10 Q So is it still -- would it still be using 16:46:36

11 your hierarchy if this command were "IF Ethernet"?

12 MR. NEUKOM: Objection. Calls for

13 speculation, vague.

14 THE WITNESS: There's many other pieces to

15 the -- there are many other pieces to the hierarchy. 16:47:00

16 This is -- I was aiming for a hierarchical,

17 symmetric, aesthetically pleasing set of

18 configuration command expressions.

19 BY MR. FERRALL:

20 Q Tell me about -- what's aesthetically 16:47:28

21 pleasing about this command expression "interface

22 Ethernet"?

23 MR. NEUKOM: Objection. Calls for opinion

24 testimony.

25 THE WITNESS: This is a command fragment. 16:47:44



1 Q Which one do you think is the Yeager 17:22:20  
2 gateway code that you threw away?  
3 A All these header files.  
4 MR. NEUKOM: I think he needs you to  
5 identify the exhibit number that you have in mind. 17:22:29  
6 THE WITNESS: Exhibit 41.  
7 BY MR. FERRALL:  
8 Q Why do you think that?  
9 A Because at Cisco I hired a contractor to  
10 implement Chaosnet. 17:22:50  
11 I've already testified that Chuck Hedrick  
12 implemented DECnet and we adopted it.  
13 And we came out of Stanford without XNS  
14 support. That was implemented by a Cisco employee.  
15 And this looks like more than one file concatenated 17:23:41  
16 together.  
17 Q Okay. Well, this was a document --  
18 Exhibit 41 was most certainly a document produced by  
19 Cisco. Do you have any idea where it came from?  
20 A I suspect that it was part of the original 17:24:08  
21 Yeager code.  
22 Q I'll just represent -- and we'll probably  
23 have to follow up with this after the deposition,  
24 but you're listed as the custodian for this document  
25 in the metadata that was produced with it. 17:24:33

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1 I don't know -- does that help you at all? 17:24:37

2 A That doesn't help me at all. This is

3 not -- I don't recognize this.

4 Q In any event, were you familiar with the

5 DEC loopback prior to your joining Cisco? 17:25:09

6 A What's the DEC loopback?

7 Q What's referred to here as Exhibit 41. It

8 refers to a DEC loopback packet, for example.

9 A No, I was not familiar with the DEC

10 loopback packet. 17:25:43

11 Q Turning back to other Cisco CLI commands,

12 you weren't the first to use the words "terminal

13 length," were you, in the context of networking?

14 A I don't know.

15 Q Did you think you were when you chose to 17:26:34

16 implement that command?

17 A When I implemented that command, I was

18 looking for a way to tell the terminal server

19 software, the Ethertip software, how many lines

20 there was on a -- on a screen, what the length of 17:27:00

21 the terminal was.

22 Q And were you inspired by TOPS-20 commands

23 when you chose that "terminal length" command?

24 MR. NEUKOM: Objection. Vague.

25 THE WITNESS: I don't remember. 17:27:33

1 BY MR. FERRALL: 17:28:02

2 Q There are many "show" commands in the  
3 Cisco CLI, correct?

4 A There's a large hierarchy of "show"  
5 commands, yes. 17:28:19

6 Q When did you first learn of any operating  
7 system command set that used the term "show" as a  
8 command?

9 MR. NEUKOM: Objection. Vague.

10 THE WITNESS: I don't recall an operating 17:29:29  
11 system that used "show." That may be my memory. I  
12 don't remember.

13 I remember TOPS-20 used "information" for  
14 a lot of stuff. I don't think UNIX had a  
15 convention. I don't remember if there was an 17:30:14  
16 operating system that used "show." All sorts of --

17 BY MR. FERRALL:

18 Q Have you ever heard of any other operating  
19 system that uses the word "show" as a command now?

20 MR. NEUKOM: Objection. Vague. 17:30:45

21 THE WITNESS: No, I do not recall at this  
22 point anyone that uses "show" other than Cisco IOS.

23 BY MR. FERRALL:

24 Q When did you determine to use the word  
25 "show" as a keyword to CLI commands? 17:31:10

1 MR. NEUKOM: Objection. Misstates prior 17:31:18  
2 testimony.  
3 THE WITNESS: To the best of my  
4 recollection, soon after I acquired the copy of the  
5 Yeager software. 17:31:42  
6 I didn't like his lack of hierarchy, so I  
7 started grouping commands that displayed the status  
8 of data structures. I started putting them under --  
9 I started building a hierarchy under "show." It was  
10 not a very deep hierarchy at the time. 17:32:07  
11 BY MR. FERRALL:  
12 Q So was "show" the first hierarchy that you  
13 built?  
14 MR. NEUKOM: Objection. Vague.  
15 THE WITNESS: I don't know if it was the 17:32:27  
16 first. It was an early one.  
17 BY MR. FERRALL:  
18 Q And tell me about the process whereby you  
19 selected the word "show."  
20 A I considered the function that I wanted. 17:32:44  
21 I wanted to see what the contents of data structures  
22 were inside the software.  
23 And I had a number of possibilities.  
24 There was "show," there was "display," there was  
25 "print," there was "list," there was "dump." All 17:33:08

1 sorts of reasonable possibilities. 17:33:12

2 And the one that appealed to me was

3 "show."

4 Q Why did "show" appeal to you?

5 A Because in my mind, I said I want to tell 17:33:31

6 the software, show me your -- show me your data

7 structures.

8 Q Why was that better in your mind than the

9 alternatives? Why was "show" better than the

10 alternatives? 17:33:51

11 A It appealed to me aesthetically. I had to

12 pick something, and that one -- that one appealed to

13 me at that time.

14 Q Had you ever heard of someone using the

15 two words "show users" together before you decided 17:34:37

16 to use that as a command?

17 MR. NEUKOM: Objection. Vague.

18 THE WITNESS: I don't have a memory of

19 that at this point.

20 BY MR. FERRALL: 17:35:30

21 Q What about the term "show hosts"? Can you

22 tell me the creative process that went into choosing

23 that command?

24 A So I wanted to see the names of the

25 computers that were on the network. 17:36:09

1 There were -- possibilities included 17:36:24  
2 something like "who," or -- that wouldn't go  
3 anywhere because I wanted to start building things  
4 into a hierarchy. And I'd already started -- okay,  
5 if I'm going to be showing some internal data 17:36:41  
6 structure which showed -- show host would show that,  
7 so I was already constrained by the choice of that  
8 keyword to -- for displaying internal data  
9 information.

```
10         I could have said something like                                     17:37:01
11     "computers." I could have said something like
12     "names," "systems," "network systems."
```

13 Some people thought "end systems" was a  
14 good thing to call -- to distinguish between  
15 computers and routers. "Host" was what I ended up 17:37:27  
16 choosing.

17 Q Okay. Were you using the word "host" in  
18 the command "show hosts" differently than how that  
19 word had been used in networking for years before  
20 that? 17:39:24

21 MR. NEUKOM: Okay. Foundation, vague,  
22 calls for opinion.

23 THE WITNESS: I'm not familiar with the  
24 years before, but I was using the term as I  
25 understood it at that time. 17:39:43

1 BY MR. FERRALL: 17:39:52

2 Q Well, you were aware that others in the  
3 computer field used the word "host," right, before  
4 you did?

5 MR. NEUKOM: Objection. Foundation and 17:40:02  
6 vague.

7 THE WITNESS: I was not aware of anybody  
8 that was using that term in a command expression in  
9 a router or gateway, as we called it then.

10 BY MR. FERRALL: 17:40:25

11 Q That wasn't my question. My question was,  
12 you were aware of people in the field of computing  
13 using the word "host," right, before you used it?

14 MR. NEUKOM: Same objections and asked and  
15 answered. 17:40:46

16 THE WITNESS: I was aware of people using  
17 the word "host" in the computer field.

18 BY MR. FERRALL:

19 Q Before you used it?

20 A Yes. 17:41:04

21 Q Now, according to your counsel, the  
22 command "show host name" was created substantially  
23 later; is that -- am I right about that?

24 MR. NEUKOM: Objection to form.

25 THE WITNESS: Are you asking me or my 17:41:41

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1 BY MR. FERRALL: 17:55:19

2 Q Mr. Loughheed, this is a document that

3 appears to be your work, according to the copyright

4 notice on the front.

5 Do you see that? 17:55:29

6 A Yes, I see that.

7 Q Okay. Do you know when -- do you

8 recognize it?

9 A Yes, I do.

10 Q What is it? 17:55:36

11 A It's a file called "globs.h." It is

12 declaring a set of variables that are used in the

13 software.

14 Q And when did you compose what's

15 Exhibit 42? 17:56:02

16 A Is there a question?

17 Q Yes. I asked when did you compose

18 Exhibit 42?

19 A Apparently June of 1985.

20 Q And you were employed by Stanford at that 17:56:28

21 time, right?

22 A Correct.

23 Q We had talked earlier about the ARP,

24 address resolution protocol.

25 Do you remember that? 17:56:57

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1 A Yes. 17:56:58

2 Q Okay.

3 A I remember you asked questions about that.

4 Q Are you familiar with there being a

5 provision for time-outs in the ARP protocol? 17:57:15

6 MR. NEUKOM: Objection. Vague and

7 compound.

8 THE WITNESS: There is the -- ARP entries

9 can become stale. If you unplug the computer or you

10 move the computer somewhere else or you replace the 17:57:43

11 network interface, entries will become stale.

12 Implementing a time-out is a way of making sure the

13 cache isn't stale.

14 BY MR. FERRALL:

15 Q Are you aware of there being a provision 17:58:10

16 for time-outs in the RFC for ARP?

17 MR. NEUKOM: Objection. Vague and

18 compound, asked and answered.

19 THE WITNESS: I'm not -- I don't remember

20 such language right now. 17:58:38

21 BY MR. FERRALL:

22 Q Did you create the term "distance BGP"?

23 A Yes.

24 Q How did you come up with that term?

25 A The Cisco IOS started supporting multiple 17:59:11

1 interior routing protocols. And customer networks, 17:59:19  
2 especially in the early days when they were attached  
3 to the -- they had campus networks running one  
4 routing protocol, they'd be attached to the NSFNET  
5 backbone as well running a different routing 17:59:39  
6 protocol.

7 And since routing protocols would give  
8 incommensurate metrics, metrics that could not be  
9 compared, I developed a concept of distance that  
10 says if one routing protocol says it knows a route 18:00:08  
11 to one destination and another routing protocol says  
12 it knows a route to that same destination, which --  
13 the routing protocol with the smallest  
14 administrative distance would be the one that would  
15 be entered into the routing table. 18:00:24

16 And so that was the problem, and my  
17 solution was the administrative distance mechanism  
18 that I described.

19 And when I implemented BGP, that was a  
20 natural extension to include for BGP as well to be 18:00:49  
21 able to configure an administrative distance to  
22 determine the believability of BGP.

23 If no routing protocol -- if only one  
24 routing protocol knew the destination, you would  
25 believe that. If there are two or more, 18:01:10

1 administrative distance was the tie-breaker. 18:01:16

2 Q Sorry. I'm going to jump back to ARP.

3 There's a term you use associated with

4 ARP, "ARP cache." We talked about that earlier in

5 looking at one of the "clear" commands, right? 18:01:52

6 Where did the term "ARP cache" come from?

7 A The cache is a -- logically a list of

8 items. An ARP cache would be a list of ARP requests

9 that have been satisfied, including their MAC

10 addresses and how long since the last time we'd seen 18:02:37

11 a -- the router had seen an ARP request go by for

12 that particular source address.

13 That sort of computer science concept of a

14 cache is found all over.

15 Q One of the commands that is indicated that 18:03:14

16 you authored is the command "boot system."

17 Had you ever heard someone use the words

18 "boot system" together before you joined Cisco?

19 MR. NEUKOM: Objection. Vague.

20 THE WITNESS: I had heard phrases like 18:03:45

21 "boot the system up," "reboot the system," "reload

22 the system," "start the system," "restart the

23 system."

24 (Exhibit 43 was marked for identification

25 and is attached hereto.) 16:48:10

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1 BY MR. FERRALL: 18:04:06

2 Q We've marked as Exhibit 43 a document

3 entitled "DECbrouter 90 Products Configuration and

4 Reference Volume 2." It bears control numbers

5 CSI-ANI-00081683 to 81683.000344. 18:04:25

6 Have you ever seen Exhibit 43 before?

7 A No.

8 Q According to the metadata of this

9 document, you are the custodian.

10 Do you have any idea why that's the case? 18:05:03

11 A No, I don't. I haven't seen it before.

12 Q Let me turn to another question.

13 Were you -- have you ever tracked the

14 extent to which other companies have used Cisco CLI

15 commands? 18:05:45

16 A No, I have not.

17 Q Are you aware of other companies using

18 Cisco CLI commands?

19 A I'm aware of Arista using Cisco CLI

20 commands. 18:06:07

21 Q Are you aware of any other company using

22 Cisco CLI commands?

23 A No, I'm not.

24 Q When did you first become aware of Arista

25 using Cisco CLI commands? 18:06:16

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1 A When Cisco announced the -- actually, it 18:06:22  
2 was in the Mercury News in the morning, and then  
3 later through internal email at Cisco.

4 Q When the suit was filed?

5 A When the suit was filed. 18:06:38

6 Q Okay. Not before?

7 A Not before.

8 Q Did you have any involvement in the  
9 litigation between Cisco and Huawei?

10 MR. NEUKOM: That's a "yes" or "no" due to 18:06:49  
11 privilege concerns.

12 THE WITNESS: No, I was not involved with  
13 Huawei.

14 BY MR. FERRALL:

15 Q Are you able to -- sorry. Strike that. 18:07:26

16 Were you involved at all in composing any  
17 of the commands that begin with "AAA"?

18 A No.

19 Q Can you tell me how the "clock set"  
20 command was composed? 18:08:07

21 A No, I cannot. I wasn't involved.

22 Q Can you tell me how any of the IPv6  
23 commands were composed?

24 A Yes.

25 Q Which ones? 18:08:30

1 A IPv6 address. IPv6 route. 18:08:37

2 Q What was your role in composing IPv6

3 address?

4 A I was creating a prototype IPv6

5 implementation. 18:09:03

6 Q Did you come up with that command, "IPv6

7 address"?

8 A Yes.

9 Q When did you do that?

10 A I believe it was 1996. 18:09:21

11 Q Did you work with anyone else on that?

12 A Yes.

13 Q Who?

14 A Dino Farinacci and Rand Atkinson, and

15 later Pedro Marquez. 18:09:42

16 Q The other one you said was IPv6 route?

17 A That may have been Dino.

18 MR. FERRALL: Let me go off the record for

19 a second.

20 THE VIDEO OPERATOR: Going off the record, 18:10:11

21 the time is 6:10 p.m.

22 (Recess, 6:10 p.m. - 6:11 p.m.)

23 THE VIDEO OPERATOR: Back on the record.

24 The time is 6:11 p.m.

25 /// 18:11:34

1 BY MR. FERRALL: 18:11:36

2 Q Did you compose the command "timers basic

3 RIP"?

4 A I believe I did.

5 Q Prior to your joining Cisco, are you 18:11:55

6 familiar with any commands that use the word

7 "timers"?

8 MR. NEUKOM: Objection. Vague.

9 THE WITNESS: No, I was not aware of any

10 operating system, general purpose or network 18:12:13

11 specific, that used -- had a "timers" command.

12 BY MR. FERRALL:

13 Q How did you come up with the command

14 "timers basic RIP"? Describe that creative process

15 for me. 18:12:30

16 A There developed a need or a desire to

17 change some of the fundamental timing constants

18 of -- I think first was the IGRP routing protocol,

19 and I implemented a command that allowed those

20 timers to be user-configured. 18:12:59

21 And later on I or someone else extended

22 that to the RIP timers so customers could speed up

23 or slow down the pulse of routing updates.

24 Q And when did that occur?

25 A 1988 or 1989. 18:13:36

1) Q How did you choose the term -- the words 18:13:39

2 "timers basic" for this function?

3 A I don't remember where "basic" came from.

4 But using the keyword "timers" was my -- was my

5 introduction, was my creation. 18:14:00

6 MR. NEUKOM: Counsel, I believe we're now  
7 beyond seven hours.

8 MR. FERRALL: Okay. Well, I -- given  
9 Mr. Loughheed's tenure at Cisco, I thank him for his  
10 time, but I will say I think we deserve some more 18:14:22  
11 time with him.

12 But I understand seven hours is up and  
13 you're going to say enough is enough for today I  
14 take it; is that right?

15 MR. NEUKOM: Certainly for today for the 18:14:31  
16 sake of the witness. And we will respectfully  
17 disagree with the idea that counsel needs more than  
18 seven hours --

19 MR. FERRALL: Okay.

20 MR. NEUKOM: -- needs more than today. 18:14:41  
21 But we can discuss that for another day.

22 In the meantime, I should note for the  
23 record the witness reserves the right to review the  
24 transcript and make corrections.

25 Brian, I'm not sure I did that for 18:14:51



1 Mr. Tjong. If you're okay with it, I'd like to just 18:14:53  
2 do a stipulation across the case that both sides  
3 have the 30-day review and errata right for all  
4 transcripts regardless whether counsel puts it on  
5 the record at the depo as a two-way street. 18:15:04

6 MR. FERRALL: That's fine. I thought it  
7 existed as a matter of procedure anyway. So that's  
8 fine.

9 MR. NEUKOM: I hope you're right, but glad  
10 to have the stipulation, even if it's unnecessary. 18:15:17

11 MR. FERRALL: Okay.

12 MR. NEUKOM: Thanks very much.

13 THE VIDEO OPERATOR: This concludes  
14 today's videotaped deposition of Mr. Kirk Lougheed.  
15 We're off the record at 6:15 p.m. Thank you. 18:15:25

16 (TIME NOTED: 6:15 p.m.)

17 --o0o--

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